

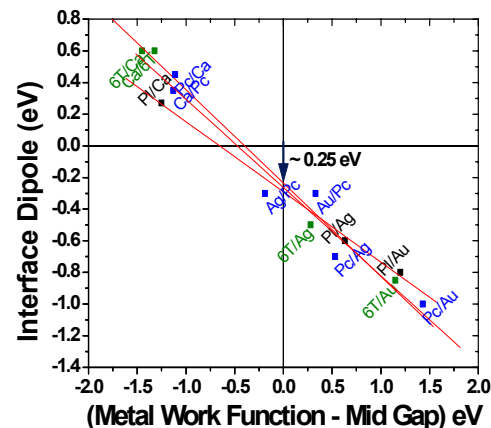
# Interfaces in Organic Thin Film Transistors

Yongli Gao, University of Rochester, DMR-9982988

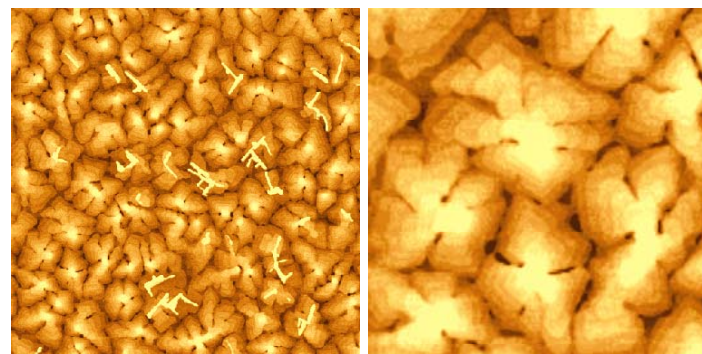
We obtained from photoemission measurements the interface dipole of representative OTFT materials as a function of the metal workfunction. The linear dependence is an indication of thermodynamic equilibrium and charge transfer. Our data show a deviation of -0.25 eV from the thermodynamics model at the mid-gap energy, which we attribute to the pushing back of the electron cloud by the organic material. These studies reveal important aspects of interface dipole formation, which determines the energy level alignment and charge injection efficiency of the interface.

There is a strong correlation between the organic thin film morphology and device performance. Pentacene forms a mixture of both regular and irregular-sized mounds on  $\text{SiO}_2$  surface. Moreover, these terraced mounds are in a shape of diffusion-limited-aggregation (DLA), as well as tip-splitting and forming dendritic mounded crystals. Such coexistence of mounded, DLA and dendritic growth has never been observed before, and may indicate a new universality class. It also indicates that the conductivity can be further improved if the grain boundary can be controlled.

Appl. Phys. Lett. **80**, 4384 (2002). Appl. Phys. Lett. **81**, 2752 (2002). Appl. Phys. Lett. **81**, 5195 (2002).



Interface dipole of metal and pentacene (Pc), sexthiophene (6T) and perylene (PI)



AFM images of pentacene thin films evaporated on  $\text{SiO}_2$  substrate

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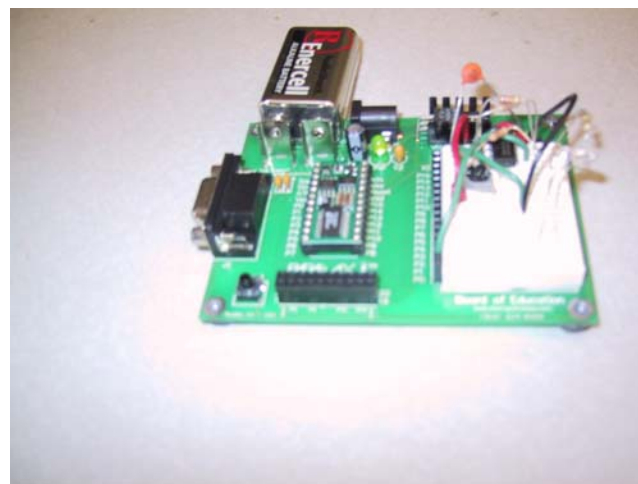
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## Education

Three graduate students (Neil Watkins, Serkan Zorba, Li Yan) and three undergraduate students (Dan Berdine, Keith Rehmann, Stewart Knox) contributed to the work. Yan got a Kodak Fellowship. Both Watkins and Yan graduated in 2003. Watkins is now a NRC Postdoc Fellow in NRL, and Yan works in University of Florida. The undergraduate students are through the REU program. Dan Berdine just obtained his MS degree from UR. Knox is continuing his research with us. We also have Prof. Akinori Tanaka and his graduate student Tazumi Nagasawa from Tohoku University, Japan visiting us and performing experiments.

## Outreach

Through a science fair sponsored by AVS Upstate NY chapter, the PI demonstrated the effect of vacuum and the operation of vacuum pump in Rochester Science Museum. The PI also developed a new undergraduate course Computer Interface in Physics Laboratory.



An infrared receiver/decoder made by Philip Scoles for his final project of the course